



Safety & Buildings Division  
201 West Washington Avenue  
P.O. Box 2658  
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Evaluation #

New Product # 20069006  
Replaces 200606-O  
Previously Replaces 200092-O

## Wisconsin Building Products Evaluation

Material

Light-Gauge Steel Diaphragm Sheeting

Manufacturer

FABRAL, INC.  
P.O. Box 4608  
Lancaster, PA 17604-4608

### SCOPE OF EVALUATION

GENERAL: GRANDRIB 3<sup>®</sup> light-gauge steel diaphragm sheeting manufactured by FABRAL, INC., was evaluated for wall and roof structural sheathing.

The **IBC** requirements below in accordance with the current **Wisconsin Amended ICC Code**:

- **Wind Loads:** GRANDRIB 3<sup>®</sup> light-gauge steel diaphragm wall and roof structural sheeting was evaluated in accordance with the wind load requirements of **s. IBC 1609.1.2**, **s. IBC 1609.1.3**, **s. IBC 1609.6.2**, and **s. IBC 1609.6.5**.
- **Seismic:** GRANDRIB 3<sup>®</sup> light-gauge steel diaphragm wall and roof structural sheeting was evaluated in accordance with the seismic requirements of **s. IBC 1620.1** through **1620.1.5**.
- **Cold-Formed Steel:** GRANDRIB 3<sup>®</sup> light-gauge steel diaphragm wall and roof structural sheeting was evaluated in accordance with the cold-formed steel requirements of **s. IBC 2205.1**.
- **Wind and Seismic Requirements:** GRANDRIB 3<sup>®</sup> light-gauge steel diaphragm wall and roof structural sheeting was evaluated in accordance with the wind and seismic requirements of **s. IBC 2211**.

### DESCRIPTION AND USE

FABRAL's GRANDRIB 3<sup>®</sup> Light-Gauge Steel Sheeting (29 gauge) is used to cover the structural framing and interior of buildings from the elements. The only structural benefit of the sheathing is to transfer applied loads to the structural framing. Loads applied normal to the plane of the sheathing allows the corrugated profile to develop the required bending strength and stiffness to support the loads normal to the plane of the sheathing as characterized by the section modulus and moment of inertia.

Light-gauge roof sections may be designed to resist in-plane shear forces such as those from wind in addition to the usual forces normal to the surface. Roof panels used as shear diaphragms can replace much or all of the in-plane frame and roof bracing.

The GRANDRIB 3<sup>®</sup> panel is 36 inches wide with 3/4 inch deep ribs on 9-inch centers, a minimum yield strength of 80,000 psi, ultimate strength of 82,000 psi minimum and modulus of elasticity of 29,500,000 psi. Each panel is protected on both sides with a galvanized coating. The panel is custom cut in lengths up to 40 feet.

## **TESTS AND RESULTS**

The basic test apparatus was the cantilever test outlined in ASAE EP 484.1 (1992) and ASTM E-455 (1984).

The panel has been tested using many cycles of intensive loading and the table below (**Table 1.**) can be used to design diaphragms to obtain the desired strength.

**Table 1. Design diaphragm strength adjusted for Load Duration Factor (LDF).**

<b>Load Type</b>	<b>Component of Diaphragm</b>	<b>Design Capacity</b>	<b>LDF</b>	<b>Design Capacity Adjusted to Normal Duration Load</b>
Bending	40d threaded hardened steel nail through purlin on edge and 2-10 ga threaded hardened steel toenails.	445 ft-lb/ft	1.56	285 ft-lb/ft
Bending	Same as above except shear connectors were also used.	660 ft-lb/ft	1.56	423 ft-lb/ft
Bending	2-10 ga threaded hardened steel nails through purlin flat.	475 ft-lb/ft	1.56	305 ft-lb/ft
Shear	Standard screw fastening pattern transferring load sheet-to-sheet.	102 lb/ft	1.51	67.5 lb/ft
Shear	Standard screw fastening pattern transferring load into/out of diaphragm.	134 lb/ft	1.51	88.7 lb/ft
Shear	Fastening same as above with an additional sheet-to-sheet purlin fastener transferring load sheet-to-sheet.	168 lb/ft	1.51	111 lb/ft
Shear	Same standard screw fastening pattern with additional sheet-to-purlin screw along rib transferring load sheet-to-sheet.	141 lb/ft	1.51	93.1 lb/ft
Shear	Same standard screw pattern with two additional sheet-to-sheet screws through rib transferring load sheet-to-sheet.	*188 lb/ft	---	188 lb/ft
Shear	Standard nail fastening pattern transferring load sheet-to-sheet.	61.7 lb/ft	1.51	40.9 lb/ft
Shear	Alternate nail fastening pattern transferring load sheet-to-sheet.	76.5 lb/ft	1.51	50.7 lb/ft
Shear	Shear connector capacity per shear connector in a row transferring load into/out of diaphragm.	**1406 lb	1.51	931 lb

\* The sheet-to-sheet seam fasteners did not fail. The tension purlin failed in tension due to bending moment. Therefore, the shear strength given is conservative.

\*\* The shear connectors did not fail during any test. The largest load transferred by the shear connector is a conservative capacity.

**Table 1.**  
**Load duration factors (LDF) are from Table 2.3.2 of the NDS (1991)**

<b>Load Duration</b>	<b>Typical Design</b>	<b>LDF</b>
Permanent	Dead Load	0.9
Ten Years	Occupancy Live Load	1.0
Two Months	Snow Load	1.15
Seven Days	Construction Load	1.25
Ten Minutes	Wind/Earthquake Load	1.6
Impact	Impact Load	2.0

- Notes:**
- 1) Wall stiffness must be modified to account for foundation stiffness (embedded post).
  - 2) Stiffness for diaphragms designed from component data of **Table 1** should be determined from the shear load versus the deflection graph see (**Figure 1.**) for the diaphragm whose construction most closely matches the designed diaphragm. Ten different diaphragm constructions have been included in this approval.
  - 3) Design strength of the diaphragm should be multiplied by the appropriate load duration factor (see **Table 1.**).

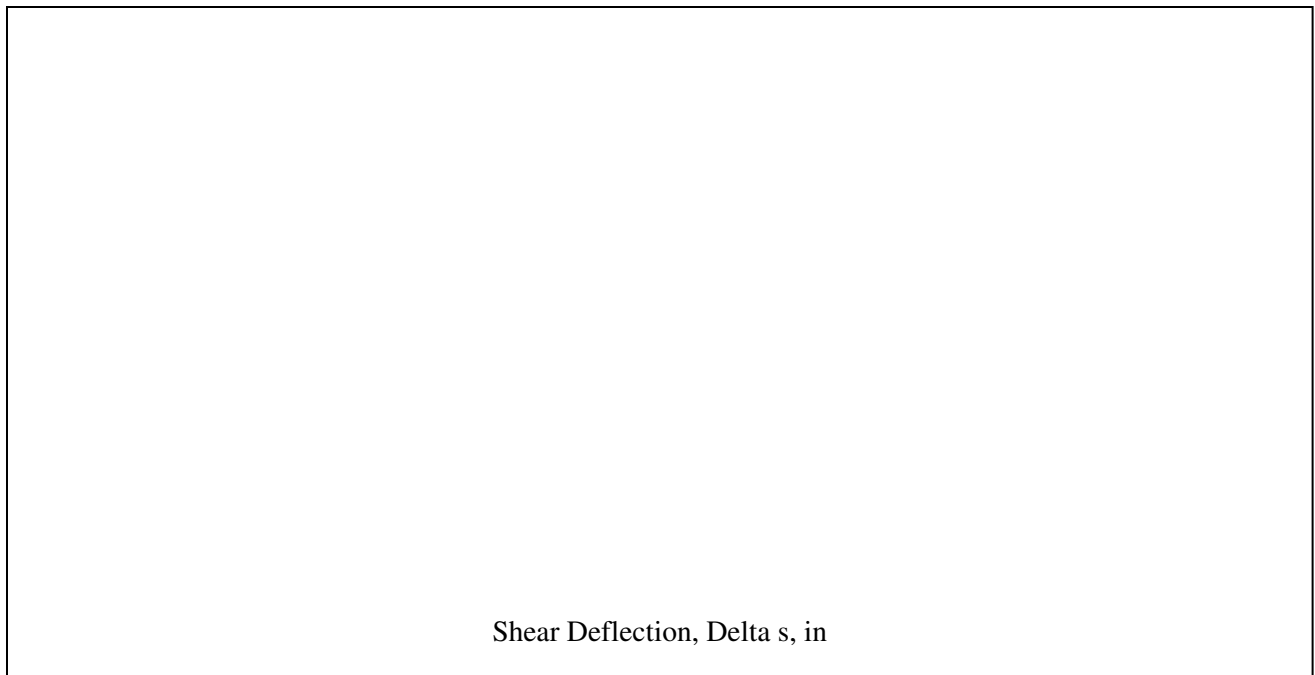
### LIMITATIONS OF APPROVAL

The **IBC** limitations below are in accordance with the current **Wisconsin Amended ICC Code**:

- **Wind Loads:** GRANDRIB 3<sup>®</sup> light-gauge steel diaphragm wall and roof structural sheeting shall be installed in accordance with the wind load requirements of **s. IBC 1609.1.2, s. IBC 1609.1.3, s. IBC 1609.6.2, and s. IBC 1609.6.5.**
- **Roof Systems:** GRANDRIB 3<sup>®</sup> light-gauge steel diaphragm wall and roof structural sheeting shall be installed in accordance with the roof systems requirements of **s. IBC 1609.7.1.**
- **Seismic:** GRANDRIB 3<sup>®</sup> light-gauge steel diaphragm wall and roof structural sheeting shall be installed in accordance with the seismic requirements of **s. IBC 1620.1 through 1620.1.5.**
- **Cold-Formed Steel:** GRANDRIB 3<sup>®</sup> light-gauge steel diaphragm wall and roof structural sheeting shall be installed in accordance with the cold-formed steel requirements of **s. IBC 2205.1.**
- **Wind and Seismic Requirements:** GRANDRIB 3<sup>®</sup> light-gauge steel diaphragm wall and roof structural sheeting shall be installed in accordance with the wind and seismic requirements of **s. IBC 2211.1, s. IBC 2211.2, , s. IBC 2211.5, s. IBC 2211.6 and s. IBC 2211.7.**

Calculations proving the diaphragm's ability to resist the wind load must be submitted with each project. Typical fastener layout must be shown on each plan submittal. All diaphragms constructed must be in accordance with the information on file.

#### **Applied Load Verses Shear Deflection**



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S1	:series	1,	first loading
S2	:series	2,	first loading
S3-2	:series	3,	second loading
S4	:series	4,	first loading
S5	:series	5,	first loading
S6	:series	6,	first loading
S7	:series	7,	first loading
S8-2	:series	8,	second loading
S9	:series	9,	first loading
S10	:series	10,	first loading

**Figure 3. Shear Load Versus Deflection For Series 1 through 10.**

**1 - 1**

- #10 - 1 ½" Long  
77 Screws

**Figure 1B. Sheet Fastening Pattern For Diaphragm Test Series 1.**

**2 - 1**

- #10 - 1 ½" Long  
113 Screws

**Figure 2B. Sheet Fastening Pattern For Diaphragm Test Series 2.**

**3 - 1**

- #10 - 1 ½" Long  
113 Screws

x #10 – 1 1/2" Long Screw  
14 Each in Seam

**Figure 3B. Sheet Fastening Pattern For Diaphragm Test Series 3.**

4 - 1

- #10 - 1 1/2" Long  
113 Screws
- x #10 - 1 1/2" Long Screw  
14 Each in Seam
- ▲ #10 - 1" Long Screw  
24 Each in Shear Connector

**Figure 4B. Sheet Fastening Pattern For Diaphragm Test Series 4.**



**5 - 1**

• #10 - 1 ½" Long Screws  
123 Each

▲ #10 - 1" Long Screw  
24 Each in Shear Connector

**Figure 5B. Sheet Fastening Pattern For Diaphragm Test Series 5.**

**6 - 1**

- 2" Long FABOSEAL Nail  
91 Each

**Figure 6B. Sheet Fastening Pattern For Diaphragm Test Series 6.**

**7 - 1**

- 2" Long FABOSEAL Nail  
91 Each

**Figure 7B. Sheet Fastening Pattern For Diaphragm Test Series 7.**

**8 - 1**

- #10 - 1 ½" Long  
113 Screws
- x #12 - ¾" Long Screw  
24 Each in Seam
- ▲ #10 - 1" Long Screw  
24 Each in Shear Connector

**Figure 8B. Sheet Fastening Pattern For Diaphragm Test Series 8.**

**9 - 1**  
**(PURLINS FLAT)**

- #10 - 1 ½" Long  
113 Screws

**Figure 9B. Sheet Fastening Pattern For Diaphragm Test Series 9.**

**10 – 1**  
**(WALL)**

- 2" Long FABOSEAL Nail  
65 Each

**Figure 10B. Sheet Fastening Pattern For Diaphragm Test Series 10.**

This approval will be valid through December 31, 2011, unless manufacturing modifications are made to the product or a re-examination is deemed necessary by the department. The product approval is applicable to projects approved under the current edition of the applicable codes. This approval may be void for project approvals made under future applicable editions. The Wisconsin Building Product Evaluation number (**200606-O**) must be provided when plans that include this product are submitted for review.

**DISCLAIMER**

The department is in no way endorsing or advertising this product. This approval addresses only the specified applications for the product and does not waive any code requirement not specified in this document.

Revision Date:

Approval Date: July 24, 2006

By: \_\_\_\_\_

Lee E. Finley, Jr.

Product & Material Review

Integrated Services Bureau

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